Does Partisanship Affect Compliance with Government Recommendations?

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Abstract

This article studies the role of partisanship in American's willingness to follow government recommendations. I combine survey and behavioral data to examine partisans' vaccination rates during the Bush and Obama administrations. I find that presidential co-partisans are more likely to believe that vaccines are safe and more likely to vaccinate themselves and their children than presidential out-partisans. Depending on the vaccine, presidential co-partisans are 4-10 percentage points more likely to vaccinate than presidential out-partisans. This effect is not the result of differences in partisan media coverage of vaccine safety, but rather in differing levels of trust in government. This finding sheds light on the far-reaching role of partisanship in Americans' interactions with the federal government.

Political partisanship is a major force in Americans' daily lives. As polarization grows (Iyengar et al. 2012), partisans are more likely to use their partisanship as a heuristic when choosing not only who to vote for, but who to work for, socialize with, and date. While the effect of partisan polarization on interpersonal relationships is well known, its effect on Americans' interactions with their government is not as well understood. Direct partisan cues may limit participation in the most polarizing programs (Lerman et al. 2017), but the US government quietly issues thousands of regulations and recommendations every year. In this article, I study the role of partisanship in Americans' acceptance of government vaccination recommendations.

Are partisans less likely to comply with government recommendations after their party loses the presidency? Are partisan gaps in compliance with government recommendations merely the result of partisan cuing from media, or are they the result of deeper changes in partisans' perceptions of government? To answer these questions, I combine survey, behavioral, and news coverage data to examine the effect of presidential co-partisanship on partisans' willingness to vaccinate.

Vaccination provides an especially fertile testing ground for my theory for three reasons. First, both Republican and Democratic administrations have recommended vaccination as a public health measure. This provides natural variation in control of government, while keeping the government recommendation constant. Second, vaccination provides a "hard test" of the hypothesis, since the consequences of non-compliance can adversely impact individuals' health. If partisanship affects receptivity to vaccination, it contains strong implications for the acceptance of other government interventions that do not carry such high costs for non-compliance. Third, there is significant survey and behavioral data on vaccine compliance. This allows me to test the effect of partisanship both on peoples' beliefs about vaccination, and their actual vaccination behavior.

I find that partisans are indeed more likely to report intent to vaccinate when their party

holds the presidency. Furthermore, I find that actual vaccination rates among partisans change after a change in the party of the presidency. These differences are not the result of partisan differences in worry about the disease, but rather their differences in perceptions of vaccine safety. I also find that differences in government trust dramatically mediate the effect of partisanship on perceptions of vaccine safety. On the other hand, partisan media coverage is unlikely to account for partisan vaccination gaps, as there is very little difference between conservative and liberal outlets' news coverage of vaccine safety,

In the next section, I discuss the theoretical debates that motivate this research. In the third section, I present the data and empirical strategies used to measure the partisan vaccination gap. The fourth section examines the survey evidence for partisan gaps in perceptions of vaccine safety in three cases, one under a Republican president and two under a Democratic one. The fifth section analyzes the effect of partisanship on actual vaccination rates. In the sixth section, I demonstrate that media cuing effects cannot explain the effect of partisanship on vaccination. The seventh section uses causal mediation analysis to test the relationship between trust in government, partisanship, and vaccination rates. Finally, I conclude by discussing the implications of these findings.

Theory

I argue that polarization influences partisans' willingness to follow government recommendations by reducing their trust in government when the opposing party holds the presidency. Distrust of members of the out-party has dramatically risen over the course of the past two decades(Iyengar et al. 2012; Mason 2016). Not only do partisans hold very negative beliefs about members of the opposing party, they are likely to discriminate against them(Iyengar and Westwood 2015). Almost half of partisans believe that policies espoused by members of the out-party are "so misguided that they threaten the nation's well being" (Pew Research Center

2016). Given this deep dislike of the opposing party, it is unsurprising that partisans would be mistrustful of the federal government when the opposing party is at its' helm.

Indeed, evidence suggests that in highly polarized political environments, partisans are unlikely to trust the out-party (Vegetti 2014). Presidential co-partisans are significantly more likely to say that they trust government than presidential out-partisans (Citrin 1974; Schaffner and Clark 2004; Pew Research Center 2010). In a weekly analysis of government trust in 2000-2001, Schaffner and Clark (2004) find that Democrats were more trusting of the federal government than Republicans until the Supreme Court decision in *Bush v Gore* confirmed Bush's victory in the presidential election. Keele (2005) finds that changes in party control of the presidency have a much greater impact on trust in government among partisans than do changes in control of Congress.

Presidential visibility is the most compelling reason why partisans are more likely to focus on the party of the president, rather than control of Congress, when deciding whether or not to trust the government. The president is far more visible than members of either house of Congress. Only 36% of Americans can correctly name which parties control Congress (Sullivan 2014), compared to the 85% who can identify the party of the president (Pew Research Center 2012). Presidents successfully exploit their superior visibility, appealing to the public to further their own policy ends at the expense of Congress(Canes-Wrone 2010; Kernell 2006).

People will be more likely to follow government regulations when their party is in power because they are more likely to cooperate with entities that they trust. Citizens who have trust in the government will be less likely to see government regulation as arbitrary, unfair, or harmful, and will thus be more likely to comply with government regulation. The empirical evidence supports this argument. High levels of trust yield more co-operation with government programs (Owen and Videras 2008; Braithwaite and Makkai 1994). Republicans, who are more likely to trust the free market than are Democrats, were more likely to sign up for Affordable Care Act's health care exchanges when they were framed as a "free market" alterna-

tive (Lerman et al. 2017).

Trust in governmental authority is a well-known predictor of compliance with government recommendations and interventions in a variety of arenas, including vaccination. The first opponents of vaccination, which arose in the mid 19th century in opposition to British smallpox vaccination laws (Porter and Porter 1988) cited their distrust of government and the medical profession as reasons for doubting the vaccine's safety. Distrust of the government was an especially salient reason for working class Britons to resist smallpox vaccination (Durbach 2004), illustrating how prior societal divisions which lead to differences in government trust can also lead to differential acceptance of government intervention. While the divisions between Democrats and Republicans today may not be as large as those between lower and upper class Britons in the 19th century, they still have a strong influence on government trust.

Partisan media cuing effects pose a possible alternative explanation for the partisan vaccination gap. Baum (2011) argues that Republican were less likely to vaccinate for H1N1 because of Fox News media coverage that disparaged the H1N1 vaccine. If partisan news organizations report on vaccines differently depending on the partisanship of the president, selective could serve as a driver of the partisan vaccination gap. However, partisan selective exposure is fairly rare (Prior 2013), as few Americans only consume news sources that align with their partisan affiliation, making it an unlikely explanation for the partisan vaccination gap.

In summary, I predict that presidential co-partisans will be significantly more likely to accept government recommendations than presidential out-partisans. Furthermore, I argue that partisan differences in acceptance of government recommendations are primarily rooted in differences in government trust, not in media consumption. Presidential out-partisans are less likely to believe that government recommendations are safe or effective than partisans whose party is in power.

Empirical Approach

In order to test my theory about the relationship between government trust, partisanship, and vaccination, I rely on four distinct sets of analyses. The first set uses surveys to look at partisans' stated beliefs about vaccine safety and willingness to get vaccinated over the course of the George W. Bush and Barack Obama administrations. The second uses vaccination data from California to measure the effect of the change in the party of the president on actual vaccination behavior. The third uses automated text analysis to explore the role of partisan media in perceptions of vaccine safety. The fourth and final set of analyses uses causal mediation to better understand the relationship between government trust and partisan perceptions of vaccine safety.

Survey Evidence Measures Individual-level Beliefs About Vaccination

I use survey data to measure two quantities of interest - perceptions of vaccine safety and reported willingness to receive the vaccine. Surveys are a reliable tool for measuring both vaccine risk perception and vaccination behavior. Survey responses to questions about vaccine risk perception have shown to accurately predict actually vaccination behavior (Brewer et al. 2007). Vaccination surveys, such as the National Immunization Survey (NIS), are used to craft public health policy in the US. In addition to directly surveying parents about their childrens' vaccination status, the NIS uses health provider vaccination records to validate parental responses. This methodology shows that parental survey responses and vaccination records have relatively high agreement[1]. Other studies also show that adult survey respondents tend to accurately report their own vaccination status (For examples, see Mac Donald et al. (1999) and Zell et al. (2000)).

While some scholars have found evidence of partisan expressive reporting about economic

[1] https://www.cdc.gov/nchs/data/series/sr_01/sr01_061.pdf

questions on surveys (Bullock et al. 2015; Prior et al. 2015), it is unlikely that partisans engage in expressive reporting about their vaccination beliefs. When partisans expressively report on surveys, they answer questions strategically in order to make their own party look good, rather than answering them sincerely. Economic performance is a traditional marker of a president's performance, and as a result partisans are likely to answer those questions strategically. Vaccine safety is not traditionally used to measure a president's performance in the same way as the economy, which disincentivizes partisan expressive reporting about vaccine safety.

I look at three cases of partisan vaccination gaps. One of these is the smallpox vaccine in 2003, during the Bush administration. The other two are the swine flu (H1N1) and measles vaccines, in 2009 and 2015, both during the Obama administration. This allows me to test whether Democrats and Republicans switch their perceptions of vaccine safety depending on which party is in power.

My main independent variable of interest is party identification, split into three categories: Republican, Democrat, and independent. The independent category was limited to pure independents - leaners were categorized with their respective party[2]. In 2002, Democrats and Democratic leaners made up 40% of the population, while Republicans and Republican leaners were 44% of the population. Pure independents made up only 7% of the population (The American National Election Studies 2017).

I use an ordered logistic model with controls for age, gender, race, income and education to measure the effect of partisanship on perceptions of vaccine safety, and a binomial logt model with the same control variables to measure partians' willingness to vaccinate.

To estimate the actual effect size of partisanship on perceptions of vaccine safety and willingness to vaccinate [3], I calculated two separate sets of predicted probabilities for the entire

[2]Unfortunately, none of the surveys available asked about strength of partisanship, so a test of strong partisan vs weak partisan was not possible. Additionally, when tested separately, leaners behaved very similarly to partisans of the party they lean towards. This is not too surprising, as leaners often mirror weak partisans in their political behavior.

[3]Partisanship is often correlated with factors such as gender and race that significantly influence risk perception.

population using a logistic model. These two sets of predicted probabilities represented each respondent's probability of vaccinating in the counter-factual world in which all respondents were Democrats, and the counter-factual world in which all respondents were Republicans. Finally, I subtracted one set of predicted probabilities from the other to get the effect size of partisanship.

Behavioral Data Measures Vaccination Rates

While surveys have been found to be a reliable measure of vaccination behavior, I use actual vaccination data to determine whether survey differences in perceptions of vaccines translate into actual differences in behavior.To measure vaccination behavior, I examined kindergarten vaccination rates and personal belief exemptions in California from 2001 to 2015, spanning both the Obama and Bush administrations. Personal belief exemptions (PBEs) are a form of vaccine exemption in which parents could claim a religious or philosophical opposition to vaccination. PBEs provide a much clearer picture of anti-vaccine sentiment than overall vaccination rates, as parents may fail to vaccinate their children for any number of reasons such as the presence of a medically recognized condition that precludes vaccination or lack of access to healthcare.

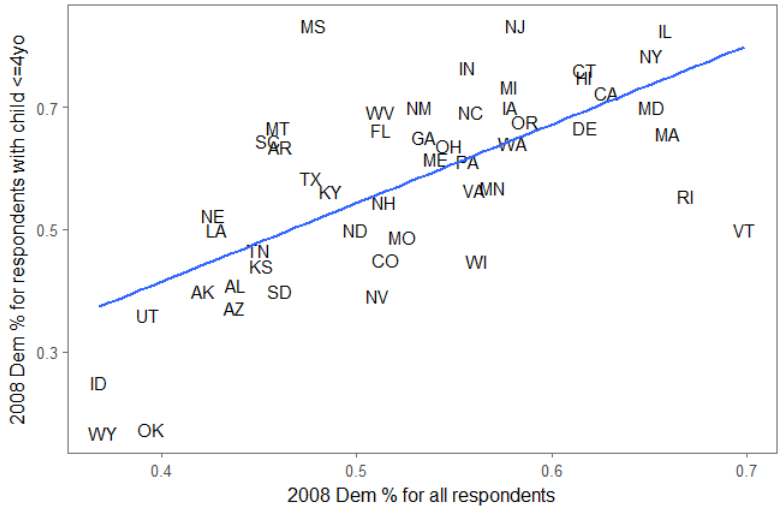
If partisans are more likely to follow government recommendations when their party is in power, Republicans should be less likely to vaccinate after Obama took office[4]. After 2008, there should be a drop in vaccination rates in districts with a higher proportion of Republicans. While the overall rate of vaccination in California may have decreased over time due to an overall increase in anti-vaccine sentiment, the my theory predicts that it should be an uneven decrease, with more Republican districts posting greater numbers of exemptions post-2008.

For example, white men (Finucane et al. 2000) are more likely to underestimate risk - they are also more likely to be Republicans

[4]While vaccination policy is decided at the state level, state level officials are much less visible than national level officials, and therefore the partisan composition of the state government is significantly less likely to influence partisans' level of government trust

To test this theory, I used a binomial logit regression with district-level random effects to estimate the effect of school district partisanship on the rate of vaccination and PBEs depending on the partisanship of the administration. Unlike a fixed effects model, a model with random effects allows me to estimate the effect of time-invariant covariates (such as 2008 Democratic presidential vote percentage) on the outcome variable of interest while still accounting for the panel nature of the data. School district vaccination data is reported by providing the yearly number of students who are vaccinated, those who have PBEs, and the total number of students in the district. I use two different dependent variables of interest - overall vaccination rates, and personal belief exemption rates. My dependent variable in the PBE regression was the proportion of students who had personal belief exemptions. In the overall vaccination regression, the DV was the proportion of students who were vaccinated.

Figure 1: State-level 2008 Democratic Vote among Parents and Non-Parents



Notes: There is a strong correlation between the 2008 presidential vote of parents with young children and the overall 2008 presidential vote. Parents of young children are slightly more Democratic. Y axis represent the state level % of CCES respondents with young children who reported voting Dem in the 2008 presidential election. X axis represents the state level % of all CCES respondents who reported voting Dem in the 2008 presidential election.

My main independent variable of interest, parental partisanship, was estimated by aggregating block-level election data from California's Statewide Redistricting database to determine

the 2008 Democratic presidential vote percentage by school district. To ensure that block-level presidential vote accurately reflects partisanship of the parents within a school district, I used data from the 2012 CCES, which asked respondents both their 2008 vote choice and whether they had a child under the age of 5. Figure 1 shows the proportion of self-reported 2008 Dem vote by state among parents of a child under 5 versus all respondents. While respondents with young children are on average about 5 percentage points more likely to vote Democrat than respondents without, the state-level correlation between under-5 parent vote and total population vote is about 0.7. This suggests that presidential vote among the general population is a relatively accurate proxy for presidential vote among parents of kindergarteners, as areas with more Democratic voteshare will also have more Democrats among parents of young children.

Measuring Media Coverage of Vaccine Safety

In order to test the role of anti-vaccine media coverage in partisan differences in vaccine safety, I did an automated content analysis of New York Times and Fox News[5] online articles about vaccination. If differential vaccine media coverage is responsible for partisan shifts in vaccination rates and perceptions of vaccine safety, then we should see a shift in news coverage of vaccines depending on the party of the presidency.

The text data was collected and processed as follows. I collected the full text of 9,698 online articles that contained the word "vaccine" (3472 from Fox, 6226 from NY Times) between 2003 and 2016. I then selected all of the sentences that contained the word "vaccine" (40,230 in total), and ran a 20-topic Vanilla Latent Dirichlet Allocation (Blei et al. 2003) topic model in order to determine the different topics discussed in these sentences. LDA is an unsupervised

[5]I chose Fox News and the New York Times for several reasons. First, both outlets are popular, "mainstream" news sources. However, they do have significant partisan skews - the plurality of Fox News consumers identify as Republicans, while the opposite is true for the New York Times (see http://www.people-press.org/2012/09/27/section-4-demographics-and-political-views-of-news-audiences/). Finally, both sites had extensive online archives dating back to 2003, allowing me to collect many years' worth of articles.

Table 1: Vaccine Topics Identified by LDA

Label	Total pct	Topic Words
General	0.110	vaccine, percent, people, children, flu, months, effective, received, age, years, risk, women, adults, dose, protection, doses, study, shots, recommended, older
H1N1	0.104	vaccine, flu, doses, million, officials, swine, health, year, government, supply, states, people, federal, shortage, season, united, supplies, shots, pandemic, expected
Research	0.091	vaccine, vaccines, virus, disease, develop, development, prevent, drugs, research, zika, effective, scientists, aids, work, malaria, people, years, treatment, developing, ebola
Autism	0.075	**vaccines, autism, vaccine, parents, children, link, evidence, thimerosal, anti-vaccine, medical, study, safety, childhood, mercury, preservative, found, research, scientific, studies, people**
Flu	0.073	vaccine, flu, virus, vaccines, strain, strains, influenza, year, viruses, made, make, effective, pandemic, protect, bird, swine, eggs, seasonal, work, live
Gates Found.	0.062	vaccines, vaccine, countries, companies, poor, developing, drugs, research, global, drug, money, foundation, world, billion, pharmaceutical, gates, development, million, make, cost
Research	0.060	vaccine, trials, trial, ebola, clinical, experimental, testing, study, vaccines, test, tested, researchers, results, aids, effective, people, africa, safety, scientists, human
Pharma	0.059	vaccine, company, drug, administration, states, food, united, approved, vaccines, glaxosmithkline, approval, flu, year, maker, sanofi, made, chiron, merck, novartis, market
Bioterror	0.054	vaccine, health, anthrax, smallpox, vaccines, government, workers, federal, military, program, human, officials, services, bush, stockpile, administration, department, care, attack, protect
Safety	0.052	**vaccine, effects, people, side, smallpox, risk, virus, risks, flu, reactions, disease, vaccines, severe, adverse, cases, vaccinated, benefit, rare, make, benefits**
Distribution	0.052	vaccine, health, vaccines, state, children, doctors, care, school, department, parents, patients, students, medical, clinics, city, york, free, schools, order, states
Diseases	0.050	vaccine, measles, vaccines, children, diseases, disease, mumps, states, meningitis, cough, rubella, united, whooping, hepatitis, infections, tetanus, pertussis, childhood, diphtheria, cases
WHO	0.045	health, vaccine, vaccines, world, public, organization, officials, experts, safety, told, meeting, news, disease, national, campaign, top, week, time, care, general
Mechanics	0.043	vaccine, immune, vaccines, system, cancer, cells, response, virus, antibodies, blood, researchers, systems, made, disease, body, called, protein, make, patients, work
Research	0.034	vaccine, university, research, director, national, institute, center, medicine, infectious, medical, diseases, health, study, professor, vaccines, development, expert, chief, school, hospital
HPV	0.034	vaccine, cancer, hpv, cervical, girls, women, human, gardasil, prevent, papillomavirus, strains, virus, sexually, boys, young, men, cancers, merck, infection, transmitted
Polio	0.026	vaccine, polio, oral, health, children, salk, fever, yellow, outbreak, nigeria, workers, pakistan, child, jonas, virus, muslim, africa, campaign, america, states
Flumist	0.026	vaccine, disease, control, centers, prevention, nasal, panel, spray, committee, advisory, flu, flumist, immunization, federal, recommended, vaccines, recommends, cdc, recommendations, experts
Misc	0.021	vaccine, vaccines, measles, doctor, cold, year-old, getty, island, photo, died, stored, rabies, york, administered, delivered, daughter, white, shot, video, received
Corrections	0.015	page, article, headline, edition, version, appears, vaccine, print, york, national, flu, october, editorial, incorrectly, december, referred, vaccines, november, misstated, july

Notes: The topics identified by the LDA covered a broad range of vaccine-related questions, from specific vaccines (flu, HPV) sentences about research and development and foreign vaccination programs. There were two topics that clearly stood out as relevant to this project - the "autism" topic, and the "safety" topic.

machine learning model that identifies common groups of words across documents and determines the proportion of each topic in each document. Table 1 shows the topics identified by the model, and their overall proportions across all of the sentences.

There were two topics of substantive interest to this project - the "Autism" topic and the "Safety" topic. Across all of the documents, about 7.5% of the words belonged to the autism topic. Of course, there was significant variance among the individual documents (sentences), with the sentence most relevant to the autism topic having a topic proportion of 95%, and a large number of sentences having a topic proportion of close to zero. Similarly, the total proportion of the safety topic across all of the documents was at 5.2%, with a similar range of distribution.

While an LDA model can tell us the overall proportion of topics in a set of documents, it cannot give us any information about the arguments made by the sentence (eg. pro- or anti-vaccine). To tackle this question, I selected sentences with at least 25% topic proportion for the autism or the safety topics for further analysis (6,880 sentences total)[6]. I then used coders from Amazon Mechanical Turk to determine whether each sentence raised concerns about vaccine safety. A sentence was coded as raising concerns about vaccine safety if it A) mentions people opting out of vaccines or concerns about vaccine safety/side effects/too many vaccines and B) does not mention science that debunks side effect claims. This definition of "raising concerns" includes both explicitly anti-vaccine argumentation, as well as reporting of actual vaccine side effects[7]. In order to prevent one outlying article from skewing the results, I counted the number of articles that had at least one sentence that "raised concerns" about vaccines and autism or vaccine safety[8].

In order to validate this method, I compared news coverage of vaccine safety by my two

[6]Using a 5% or 10% cutoff yielded similar results

[7]I used a broad definition of "raising vaccine safety concerns" because an article mentioning that "many people are opting out of vaccines" could easily have a similar effect on perceptions of vaccine safety as a more explicitly anti-vaccine article(Kahan 2014)

[8]Analyzing the number of sentences did not appreciably change the results

"mainstream" sources with coverage done by the National Vaccine Information Center (NVIC), a long-standing anti-vaccination group (Offit 2011). If my method can detect anti-vaccine media coverage, it should rate the vaccine coverage from the NVIC as decidedly more skeptical of vaccine safety than from the mainstream news sources. I scraped all of the pages on the NVIC's website (yielding 1654 pages), and selected all of the sentences that contained the word "vaccine" (51,523 in total). I then ran an LDA on the full combined dataset of sentences (40,230 from mainstream sources + 51,523 from the NVIC = 91,723 total)[9]. I identified the three most explicitly vaccine-related topics, and selected the sentences that had at least 25% topic proportion. I then randomly sampled 1000 sentences each from both the mainstream and and NVIC sources, and used the same mturk coding protocol as previously described in order to determine whether each sentence "raised concerns" about vaccine safety.

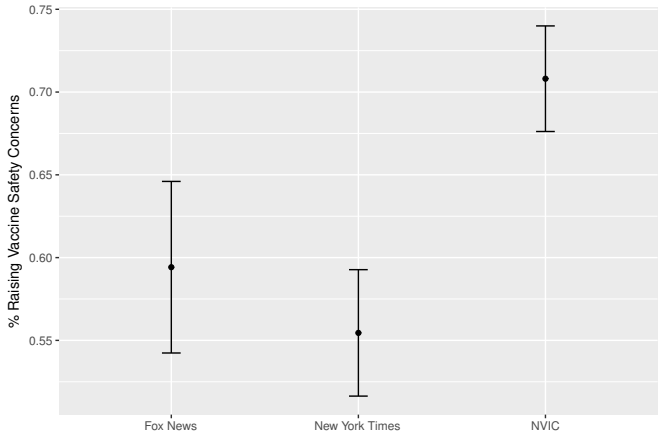
The anti-vaccine and mainstream media outlets had very different approaches of coverage of vaccine safety. First, 29% of the sentences from the anti-vaccine outlet mentioned vaccine safety (had over 25% safety topic proportion), compared to only 19% of the sentences from the mainstream outlets. Furthermore, as expected, the anti-vaccine outlet was also more pessimistic about vaccine safety. Figure 2 shows that while about 55% of the vaccine safety sentences from the New York Times raised concerns about vaccine safety, compared to 70% of sentences from the NVIC. This provides strong validation for the coding methodology, as anti-vaccine media outlets were both more likely to cover vaccine safety and more likely to report negatively on vaccine safety.

Measuring the Effect of Trust on Vaccination

In this paper, I test the hypothesis that the partisanship of the president influences vaccination rates because it makes presidential out-partisans less likely to trust the government.

[9]For the LDA topics from the validation, please see the appendix

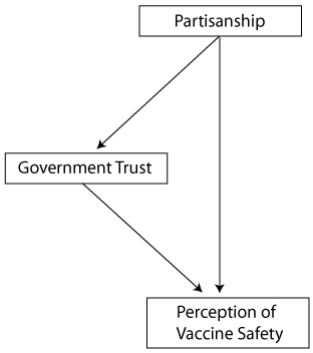
Figure 2: Validating Mturk Coding



Notes: The methodology described in this section is able to distinguish between the amount of anti-vaccine content in mainstream (New York Times, Fox News) and dedicated anti-vaccine (NVIC) outlets. Mturk coders scored the NVIC as significantly more anti-vaccine than either Fox News or the New York Times.

To do this, I use a causal mediator model which assesses the degree to which government trust explains partisan differences in beliefs about vaccine safety. Mediation analysis is used widely in the social sciences to test potential mechanisms through which a variable such as partisanship influences behavior. Mediator models make it possible to test whether a potential mediator completely or partially reduces the effect of partisanship on vaccine beliefs and behavior.

Figure 3: Mediator Model



Notes: This model proposes one causal mediator - trust in government. The total effect is the sum of the direct effect of partisanship on perceptions of vaccine safety and the causal mediation effect of trust in government.

Some scholars have debated the effectiveness of mediation analysis, especially for observational data (Bullock et al. 2010). I present mediation analysis as only one piece of evidence for the partisan trust theory. If mediation analysis failed to find that trust in government was a significant mediator for partisanship in beliefs about vaccination, this would be a serious piece of evidence against my

theory.

I ran a simple mediator model to test if government trust explained partisan differences in perceptions of vaccine safety, described in figure 3. According to my theory, partisan differences in government trust should explain differences in perceptions of vaccine safety.

Unfortunately, data about government trust were not available in the smallpox case, limiting my analysis to the H1N1 and measles cases. I use the mediation model presented in Imai et al. (2010) because it allows for the use of non-linear models such as ordered logit in the mediation analysis[10].

In both the measles and H1N1 cases, I used partisans' self-reported perceptions of vaccine safety as my outcome variable. As the mediator variable, I used a variable that asked respondent about how often they trusted the federal government to do the right thing. I limited my analysis only to Democrats/leaners and Republicans/leaners in order to test the effect of being an out-partisan[11]. I controlled for age, race, ethnicity, gender, and education in both equations. To measure the effect of partisanship on government trust, I used an ordered logit model as the first step in my mediation analysis. Then, I modeled the second step, which calculated the effect of the mediator on the outcome variable using an ordered logit with the vaccine safety measure as the dependent variable.

Presidential Co-Partisans Are More Likely to Believe in Vaccine Safety

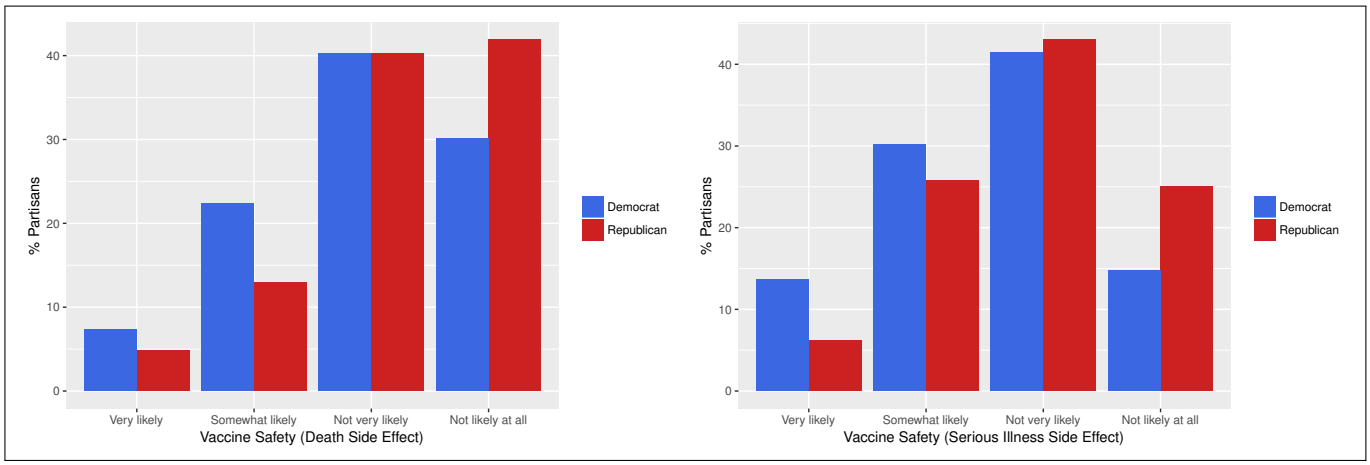
Figure 4 plots the raw proportions showing partisans' perceptions of vaccine safety under a Republican and a Democratic president. As the figure shows, Republicans were more likely to

[10] Additional information about the mediator model is available in the appendix

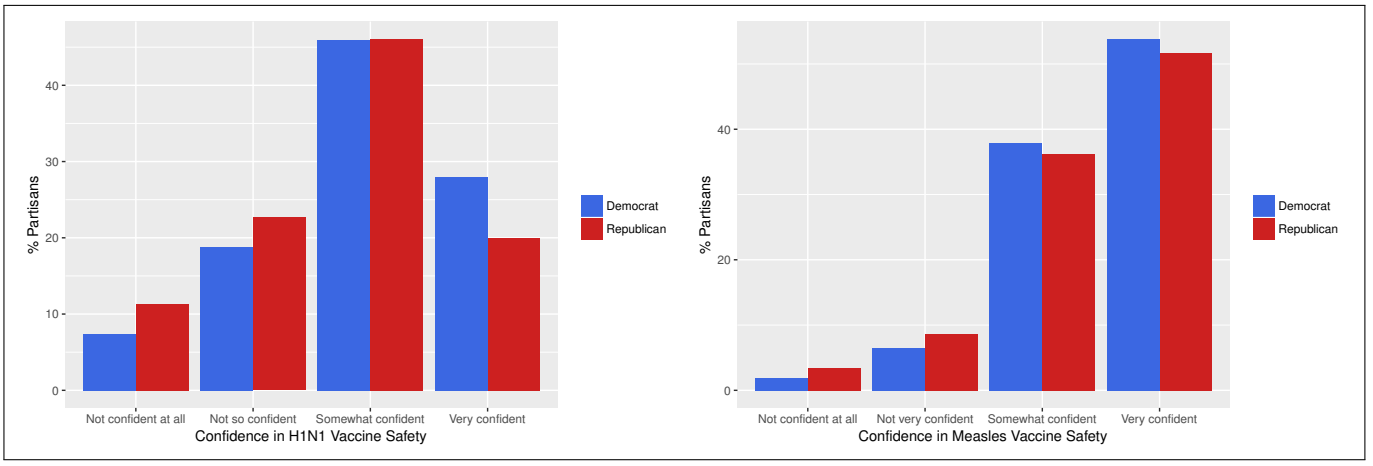
[11] Pure Independents make up only about 10% of my sample, and running the mediation analysis using in-partisan (Dem) vs not in-partisan (Rep + pure Ind) yields basically the same results

Figure 4: Partisan Perceptions of Vaccine Safety

Republican President:



Democratic President:



Notes: Presidential co-partisans are more likely to believe that vaccines are safe than presidential out-partisans. X-axis represents partisan perceptions of vaccine safety. For smallpox, X-axis is flipped (Partisans who say side effects are "Not Likely at All" are on the right, since they have the strongest belief in vaccine safety). Y-axis is percent of Democrats or Republicans who responded with each option.

believe that vaccines were safe under a Republican president (smallpox vaccine), and Democrats believed the opposite (H1N1, measles). Partisan survey responses to perceptions of vaccine safety seem to "flip" depending on the party of the president.

Table 2 presents the ordered logistic regression estimates for perceptions of vaccine safety for the three vaccines. In all three cases, presidential co-partisans were significantly more likely to believe that the vaccine was safe. In the case of the smallpox vaccine, Republicans were more likely to believe that the vaccine was safe, while in the cases of H1N1 and measles, the opposite was true. This finding strongly supports the hypothesis that partisans are more likely to believe that vaccines are safe when their party holds the presidency. In two of the three cases, Independents were also significantly less likely to believe that the vaccine was safe.

Table 2: Partisan Perceptions of Vaccine Safety

	Republican President:	
	Smallpox Safety (Illness side effect)	Smallpox Safety (Death side effect)
Pres. Co-Partisan (Rep)	–	–
Independent	-0.371*(0.156)	-0.217(0.16)
Pres. Out-Partisan (Dem)	-0.433**(0.163)	-0.33†(0.174)
Full Table in Appendix...		

	Democratic President:	
	H1N1 Safety	Measles Safety
Pres. Co-Partisan (Dem)	–	–
Independent	−0.212(0.263)	−0.766** (0.077)
Pres. Out-Partisan (Rep)	−0.624**(0.132)	−0.378** (0.072)
Full Table in Appendix...		
Note:		†p<0.1; *p<0.05; **p<0.01

Notes: In all three cases (smallpox, H1N1, and measles), presidential co-partisans were significantly more likely to believe that vaccines were safe. All four columns represent the results of an ordered logit regression. For the smallpox questions, the order was flipped ("Not likely at all" was the largest value, "Not very likely" was second largest etc, as lower values of side effect concern represent higher confidence in vaccine safety). Full tables are in the appendix (regressions contain the following covariates: age, gender, race/ethnicity, income, education).

The effect size of partisanship on perceptions of vaccine safety was substantial. On average, out-partisans (Democrats) were 11 percentage points more likely than co-partisans (Republicans) to believe that serious illness was a "very likely" or "somewhat likely" side effect of the smallpox vaccine, and 5 percentage points more likely to believe that death would be a "very likely" or "somewhat likely" side effect. In the case of the H1N1 vaccine, out-partisans (Republicans) were 10 percentage points more likely to say that they were "Not so confident" or "Not confident at all" in the safety of

the H1N1 vaccine than co-partisans (Democrats). Finally, in the case of measles, out-partisans (Republicans) were 4 percentage points more likely than co-partisans (Democrats) to be "Not very" or "Not at all" confident in the safety of the measles vaccine.

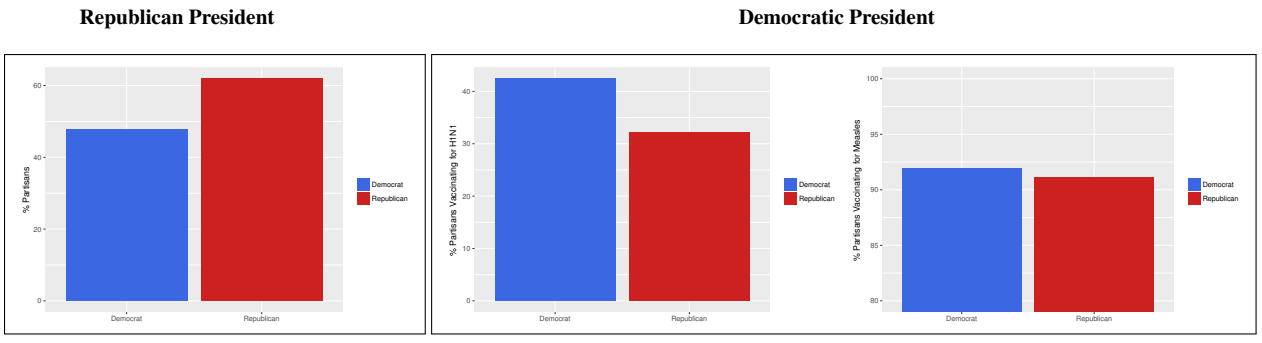
This section has demonstrated that presidential co-partisans are indeed more confident in the safety of vaccines than presidential out-partisans. These effects are significant and sizable, ranging from 4% for the measles vaccine to 11% for the smallpox vaccine. The next section looks at partisans' differential vaccination rates[12].

Presidential Co-Partisans Are More Likely to Vaccinate Their Children

Figure 5 presents the raw percentage of partisans who would vaccinate themselves or their kids in the cases of smallpox, H1N1, and measles. In all three cases, presidential out-partisans

[12]Perceptions of vaccine safety play a large role in partisans' willingness to vaccinate. Partisans' worries about the disease do not. For analysis of the relative contributions of vaccine safety and disease worry to partisans' vaccination decision, please see the appendix

Figure 5: Partisan Willingness to Vaccinate



Notes: In all three cases, presidential co-partisans were more likely to vaccinate their children than presidential out-partisans. In the cases of smallpox and H1N1, the differences were large (over 10 percentage points), while in the case of MMR, the raw partisan difference was much more modest (about 1 percentage point)

(Dems for smallpox, Reps for H1N1 and meases) were less likely to report willingness to vaccinate than presidential co-partisans. Table 3 presents the binomial logit coefficient estimates on partisanship, confirming that the effect of partisanship on vaccination is statistically significant.

I calculated predicted effect size similarly to the previous section. In the cases of smallpox and H1N1, presidential co-partisans were about 10 percentage points more likely to vaccinate than presidential out-partisans. For the measles vaccine, the effect size was closer to 3 percentage points. The difference in effect size may be the result of a number of factors, including the familiarity of the MMR vaccine, its' administration to children, or the question wording[13].

Table 3: Partisan Willingness to Vaccinate

	Republican President:
	Smallpox
Pres. Co-Partisan (Rep)	–
Independent	-0.572*(0.253)
Pres. Out-Partisan (Dem)	-0.588**(0.146)
Full Table in Appendix...	

	Democratic President:	
	H1N1	Measles
Pres. Co-Partisan (Dem)	–	–
Independent	-0.403(0.286)	-1.012**(0.125)
Pres. Out-Partisan (Rep)	-0.449**(0.153)	-0.410**(0.134)
Full Table in Appendix...		
Note:		†p<0.1; *p<0.05; **p<0.01

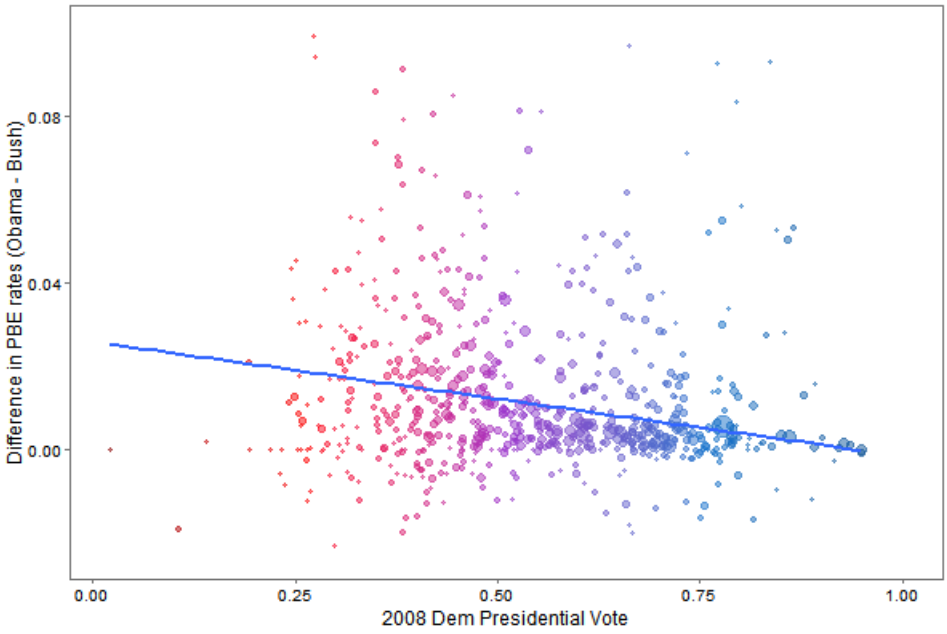
Notes: In all three cases, presidential co-partisans were significantly more likely to vaccinate than presidential out-partisans. All three columns represent the results of a binomial logit regression. Full tables are in the appendix (regressions contain the following covariates: age, gender, race/ethnicity, income, education).

Now, while presidential co-partisans said they were more willing to vaccinate themselves and their children, was this an instance of cheap talk, or an indicator if genuine behavior? To test this question I relied on actual kindergarten vaccination and personal belief exemption data from the state of California over the course of the Bush and Obama administrations (2001-2015).

Figure 6 shows the raw change in PBE rates for each school district in California from the Bush to the Obama administrations. While the most Democratic school districts did not experience any increase in PBEs from the Bush to the Obama administration, the most Republican

[13]The smallpox and H1N1 questions asked if respondent would or would not be willing to vaccinate. The measles questions asked if respondents would be willing to vaccinate or seek an exemption.

Figure 6: Difference in PBE Rates by administration and partisanship



Notes: Partisanship significantly correlated with increases in personal belief exemptions after Obama became president. School districts with more Republican voters became much more likely to claim PBEs after Obama became president.

districts experienced an increase of about 3%. An effect of this magnitude represents a potentially serious public health problem, as it represents thousands of kindergarteners missing out on vaccines. Some diseases, such as pertussis or measles, require 94% of a population to be vaccinated in order to achieve population immunity and prevent the spread of disease - a 3% increase in PBEs could easily put population immunity at risk. Table 4 confirms that after Obama's election, the increase in PBE rates was much larger in Republican school districts than in Democratic ones, as was the decline in vaccination rates.

Using both survey and behavioral data, this section has demonstrated that presidential co-partisans are significantly more likely to vaccinate themselves and their children than presidential out-partisans. Next, I will test three alternative non-partisan hypotheses to highlight the stability of the partisan effect on vaccination.

Alternative Explanations Do Not Account For Differences in Vaccination Rates

In this section, I tackle threats to the validity of my behavioral results. First, laxity in vaccination has consequences. It is reasonable to expect that areas with fewer vaccinated children will have more disease outbreaks. This, in turn, should motivate school officials to more strictly enforce vaccination regulations. Perhaps the most Democratic school districts were on the front end of the anti-vaccine trend, then faced increasing rates of vaccine-preventable disease, which caused their vaccination rates to rise? If the increase in disease (and subsequent stricter enforcement of vaccine regulations) occurred around 2008, the outcome would be observationally equivalent to a partisan effect.

In order to test this alternative hypothesis, I relied on county-level disease data from the California Health and Human Services Department[14]. To get the lagged vaccine preventable disease rate, I summed up the number of cases of Diphtheria, Tetanus, Pertussis, Measles, Mumps, Rubella, Hepatitis B, and Varicella Hospitalizations for the prior year, and then divided by the total county population. As the dependent variable, I aggregated the school district vaccination and PBE rates to the county level, and used county-level demographic covariates. Otherwise, the regression specification was identical to the specification in the prior section (table 4). If partisan change in vaccination rates during the Obama administration is the effect of stricter vaccine enforcement in counties with high

Table 4: CA Vaccination and PBE Rates (2001-2015)

	Dependent variable:	
	PBE Rate	Vaccination Rate
	(1)	(2)
% 2008 Dem vote	0.889^{**} (0.247)	-1.714^{**} (0.190)
Obama Admin	0.454^{**} (0.030)	-0.657^{**} (0.016)
% 2008 Dem vote x Obama	-0.347^{**} (0.047)	0.585^{**} (0.022)
Full Table in Appendix		
Note:		†p<0.1; *p<0.05; **p<0.01

Notes: Presidential out-partisans became less likely to vaccinate after Obama was elected president. Both columns represent the coefficients of a binomial logit regression with random effects, with each child who recieved a PBE (1) or was vaccinated (2) as a 1, and otherwise a 0. Full tables are in the appendix (regressions contain the following school district level covariates: race/ethnicity, income, education)

[14]https://data.chhs.ca.gov/dataset/infectious-disease-cases-by-county-year-and-sex

disease rates, including this variable in the regression should remove the significance on the Dem vote x Obama admin term.

Table 5 shows the results of the binomial logit regression. Including the lagged disease rate variable does not substantively change the results - Republicans still became less likely to vaccinate and more likely to claim PBEs during the Obama administration. This result is highly robust to model specification. Removing the interaction between Obama admin and lagged disease does not change the results, nor does lagging the disease rate at 0, 2, or 3 years instead of 1. Similarly, the Dem Vote x Obama Admin interaction is still significant if the lagged disease variable is completely removed. As such, it is unlikely that the partisan effect measured is the result of stricter vaccine enforcement in high-disease areas.

Table 5: Controlling for Lag Vax-Preventable Disease

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	0.762 (0.762)	-1.553^{*} (0.665)
Obama Admin	0.336^{**} (0.041)	-0.812^{**} (0.024)
% 2008 Dem vote x Obama	-0.443^{**} (0.071)	0.893^{**} (0.047)
Lag VPD Rate	-665.099^{**} (36.115)	-207.596^{**} (17.859)
Lag VPD Rate x Obama	347.527^{**} (40.989)	150.001^{**} (30.091)
Full Table in Appendix		
Note:		†p<0.1; *p<0.05; **p<0.01

Notes: Including the rate of vaccine-preventable diseases in the regression did not change the effect of partisanship on vaccination rates. Full tables are in the appendix (regressions contain the following county-level covariates: race/ethnicity, income, education)

The second test concerns a potential "catch up" effect among under-vaccinated school districts. It is possible that given the rising concern around low vaccination rates, school district officials in districts with low rates began enforcing vaccination regulations more strictly even if they did not see an increase in disease outbreaks[15]. To test this hypothesis, I added a lagged vaccination rate/PBE rate covariate to the regression presented in table 4, as well as an interaction between lagged vaccination x Obama admin (in case the "catch up" period corresponded with the Obama administration). If the observed partisan effect is the result of under-vaccinated school districts "catching up", the interaction between Dem vote x Obama Admin should lose significance. Table 6 shows that for both vaccination rates and PBEs, including

[15] An alternative could also be true - anti-vaccine beliefs may have originally been popular in some school districts, which had lower vaccination rates, but eventually spread to other districts. This robustness check tests both possibilities

a lagged variable does not change the partisan effect. Changing the lag to 2 or 3 years does not change this result, nor does removing the iteraction between Obama admin and the lagged variable. This means that it is unlikely that the partisan effect is the result of a "catch up" effect.

Finally, as my third test, I look at the relationship between income and vaccination rates. It is possible that anti-vaccine sentiment may have first been popular among richer households, and then spread to poorer ones (or vice versa). If the time period in which anti-vaccine sentiment became popular among different economic strata corresponded to the Obama administration, then the partisan effect I observe may be the result of wealth, not partisanship. To test this effect, I added an interaction term between Obama admin x median household income to the equation from table 4. If wealth is the true driver of the observed effect, the significance on the Obama x Dem vote coefficient should disappear. Table 7 shows that the Obama administration effect for presidential co-partisans still hold even when I allow for the possibility of a wealth effect. This means that it is unlikely that the observed partisan effect is the result of income effects.

Table 6: Controlling for Lagged Vaccination Rate

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	$0.429^{\dagger}$ (0.224)	-1.058^{**} (0.143)
Obama Admin	0.460^{**} (0.031)	-0.339^{**} (0.048)
% 2008 Dem vote x Obama	-0.230^{**} (0.048)	0.448^{**} (0.023)
Lag PBE Rate	3.171^{**} (0.124)	
Lag PBE x Obama	-1.756^{**} (0.101)	
Lag Vaccination Rate		3.003^{**} (0.047)
Lag Vaccination x Obama		-0.198^{**} (0.048)
Full Table in Appendix		
Note:		†p<0.1; *p<0.05; **p<0.01

Notes: Including the lagged vaccination rate in the regression did not change the effect of partisanship on vaccination rates. Full tables are in the appendix (regressions contain the following school district level covariates: race/ethnicity, income, education)

This section has shown that the partisan effect in vaccination behavior is robust to disease, "catch up", and income effects. The next section tackles the question of media coverage and perceptions of vaccine safety - did liberal and conservative outlets report different on vaccine safety depending on which party held the presidency?

Media Cuing Effects Do Not Explain Partisan Vaccination Gaps

In order to test the effect of media coverage on partisans' anti-vaccine beliefs, I did an automated text analysis of vaccine news content published by the New York Times and Fox News. If selective exposure to partisan media is driving partisan vaccination gaps, there should be significant differences in the way that partisan media sources report on vaccines depending on which party is in power.

Table 7: Controlling for Income Effects

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	0.894^{**} (0.247)	-1.665^{**} (0.190)
Obama Admin	0.460^{**} (0.030)	-0.609^{**} (0.016)
% 2008 Dem vote x Obama	-0.347^{**} (0.047)	0.509^{**} (0.023)
Median HH Inc	-0.090 (0.057)	0.176^{**} (0.044)
Median HH Inc x Obama	-0.020^{*} (0.008)	-0.080^{**} (0.004)
Full Table in Appendix		
Note:		†p<0.1; *p<0.05; **p<0.01

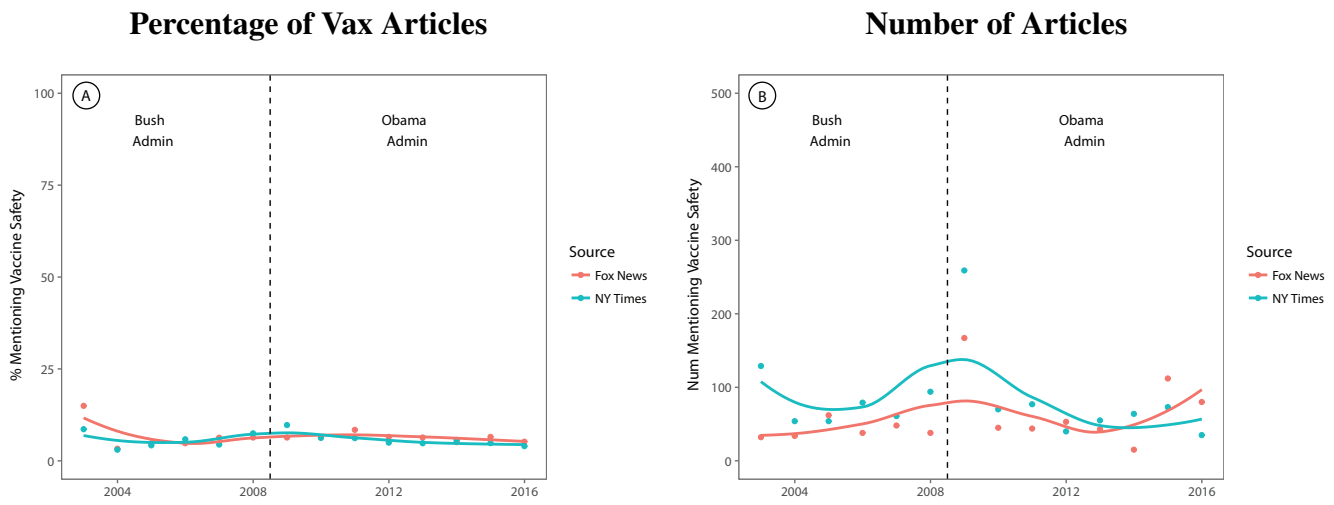
Notes: Including an interaction between school district level income and Obama admin did not change the effect of partisanship on vaccination rates. Full tables are in the appendix (regressions contain the following school district level covariates: race/ethnicity, income, education)

Figure 7 plots the percentage and number of vaccine articles that had at least one sentence mentioning the vaccine safety topic. Figure 8 does the same for the autism topic. Neither Fox news nor the New York Times substantially changed the proportion of articles devoted to vaccine safety after Obama was elected.

Nor did either news outlet change the tone of their vaccine safety coverage. Figure 9 shows the percentage and number of vaccine articles that contained at least one sentence that raised vaccine safety concerns, and Figure 10 does the same for autism. Both Fox news and the New York Times offered very consistent coverage of vaccine safety during this time.

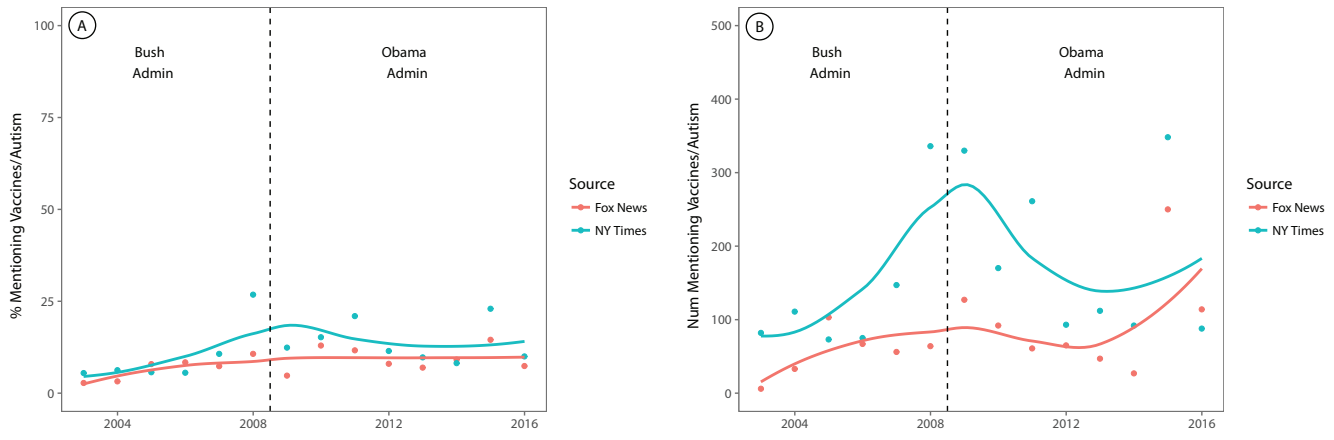
This section has shown that there were no significant changes in coverage of vaccine safety by partisan media outlets after Obama was elected, making the selective media exposure explanation for the partisan vaccination gap implausible. In the next section, I will provide evidence for differential government trust as the motivator of partisan vaccination differences.

Figure 7: Articles Containing Vaccine Safety Sentence



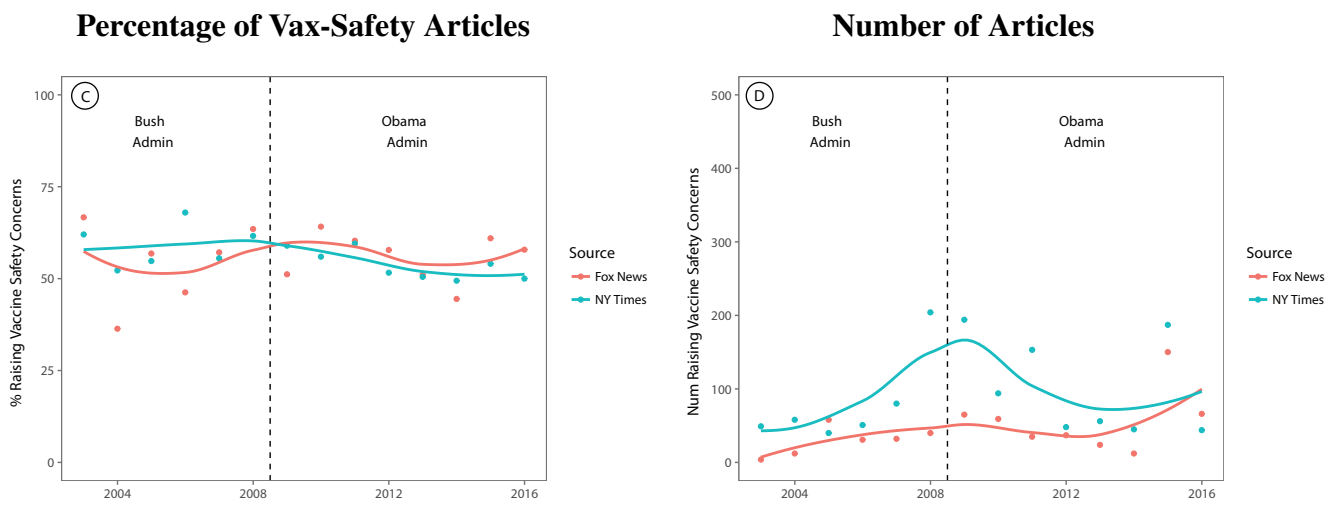
Notes: Neither the New York Times nor Fox News substantially increased their coverage of vaccine safety after the presidency switched parties. The first panel (A) shows that on average only about 10% of articles each year contained at least one sentence mentioning the vaccine safety topic. The second panel (B) shows that for both media sources this amounted to fewer than 100 articles per year, with the exception of 2009 (the H1N1 pandemic)

Figure 8: Articles Containing Vaccines-Autism Sentence



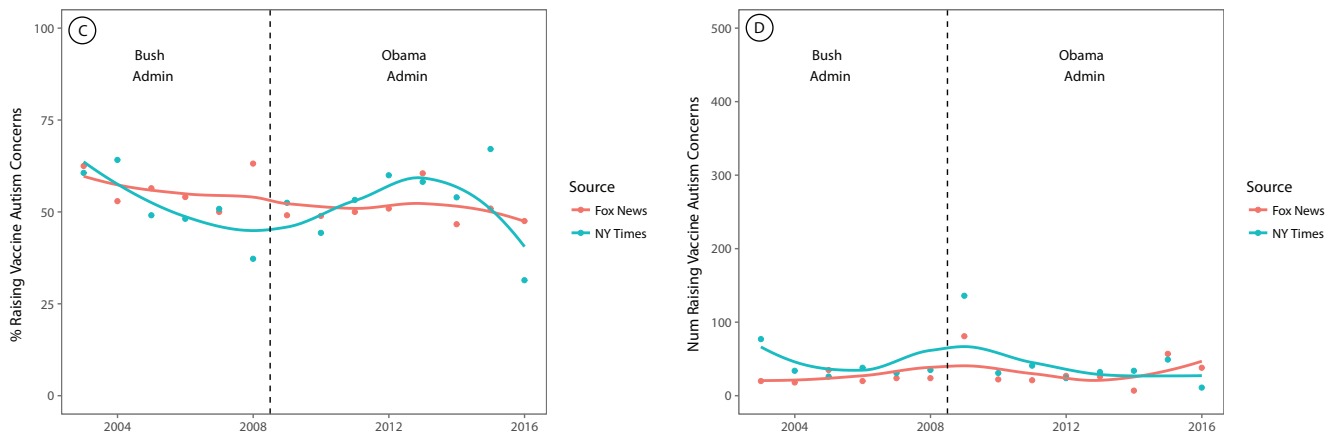
Notes: Neither the New York Times nor Fox News substantially increased their coverage of vaccines and autism after the presidency switched parties. The first panel (A) shows that on average fewer than 10% of articles each year contained at least one sentence mentioning the autism topic, with the exception of the NY Times in 2008, 2011, and 2015, where the proportion topped 20%. These years roughly corresponded to news about the Andrew wakefield case. The second panel (B) shows that the largest number of vaccination/autism articles appeared in 2008, 2009, 2011, and 2015.

Figure 9: Vaccine Safety Articles Raising Safety Concerns



Notes: Both Fox News and the New York Times were very consistent in their reporting about vaccine safety. The first panel (C) shows that of all the articles that contained the vaccine safety topic, around 55% contained at least one sentence that raised concerns about vaccine safety. Both Fox news and NYTimes were similar and consistent on this measure. The second panel (D) shows that, on average, this amounted to fewer than 100 articles per year for both the New York Times and Fox News.

Figure 10: Vaccines-Autism Articles Raising Safety Concerns



Notes: Both Fox News and the New York Times were mostly consistent in their reporting about vaccines and autism. The first panel (C) shows that of all the articles that contained the vaccines/autism topic, around 50% contained at least one sentence that raised concerns about vaccine safety. Both Fox news and NYTimes were similar and relatively consistent on this measure. The second panel (D) shows that, on average, this amounted to fewer than 100 articles per year for both the New York Times and Fox News.

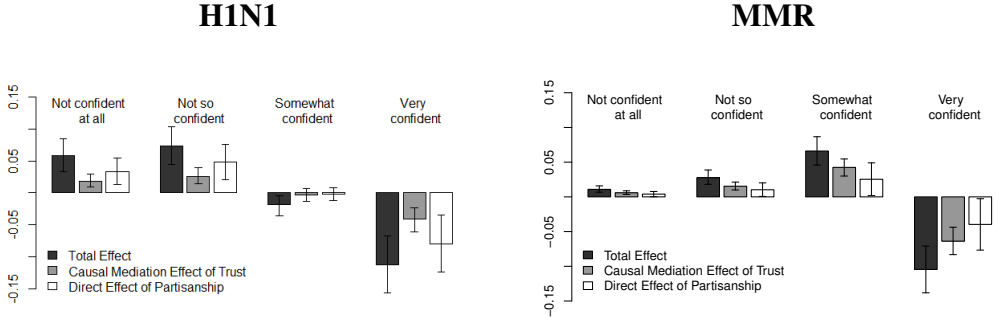
Government Trust Plays a Central Role in Safety Perceptions

In order to examine the role of government trust in partisan perceptions of vaccine safety, I turned to causal mediation analysis. Unfortunately, there was no government trust question in the smallpox survey, so I could only do this analysis for the H1N1 and the measles vaccines.

Figure 11 plots the mediation effect of government trust on the partisan gap in vaccine safety perceptions. In both cases, government trust significantly mediates the effect of partisanship on perceptions of safety. In the case of measles, government trust mediates approximately 58% of the total partisan effect. In the case of H1N1, government trust mediates approximately 34 % of the total partisan effect.

This section shows that government trust plays a powerful role in explaining partisan vaccination gaps. This provides additional support for my theory that partisanship shapes citizens' perceptions of their government's competence and trustworthiness, changing their willingness to comply with its recommendations.

Figure 11: Does Government Trust Explain Partisan Differences in Perceptions of Vaccine Safety?



Notes: Government trust is a significant mediator of the partisan vaccination gap in perceptions of vaccine safety. In the case of MMR, the direct effect of partisanship is no longer significant.

Conclusion

Are presidential out-partisans less likely to comply with government recommendations? In the case of vaccination, the answer appears to be yes. Presidential out-partisans were significantly less likely to believe that vaccines were safe, and less likely to vaccinate their children than were presidential co-partisans. During the Bush administration, Democrats were both significantly more skeptical of the smallpox vaccine, and less likely to comply with mandatory school vaccination policies. During the Obama administration, the vaccination gap flipped and Republicans became more hostile to vaccines. These partisan differences in vaccine compliance were not the result of differential levels of worry about vaccine-preventable diseases, nor were they the result of stricter enforcement in under-vaccinated school districts. Instead, they could be largely attributed to partisan differences in perceptions of vaccine safety.

Partisan differences in perceptions of vaccine safety were also not the result of differential media coverage. Both the New York Times and Fox News were fairly consistent in their vaccination coverage during both the Bush and Obama administrations. On the other hand, partisan differences in government trust significantly mediated partisan differences in perceptions of vaccine safety,

In the 21st century, political partisanship has emerged as a key predictor not only of Americans' political behaviors, but of their non-political ones as well. Vaccination, while crucial to maintaining the nation's health, is only one form of government recommendation. If rising polarization causes partisans to selectively opt out of government health and safety recommendations when their party is out of power, this has dire consequences for the nation as a whole.

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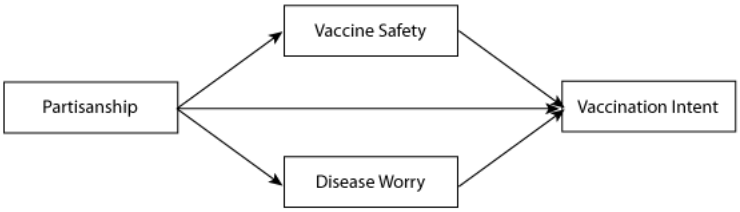
What Influences Vaccine Choice? Appendix

People use multiple pieces of information when deciding whether or not to vaccinate. These considerations may include perceptions of both vaccine safety and concerns about the risk of the disease. To more rigorously test the relationships between partisanship, vaccine safety, and vaccination decision, I used a multiple mediation model (as described in Tingley et al. (2013)) in to determine whether perceptions of vaccine safety mediated the partisanship effect on vaccination decision, and compare it to the mediator effect of disease worry on vaccination decision.

Figure A1 shows the mediator model, which proposes two potential causal pathways. In the first potential causal pathway, termed "vaccine safety", partisans of the president's party are more likely to believe that vaccines are safe, and therefore more likely to vaccinate. In the second possible causal pathway, partisans of the president's party are more likely to worry about the disease in question, and are therefore more likely to vaccinate. The multiple mediation model allows me to test both pathways simultaneously and see whether one or both significantly mediate the effect of partisanship on vaccination decision.

Figure 12: Multiple Mediator Model

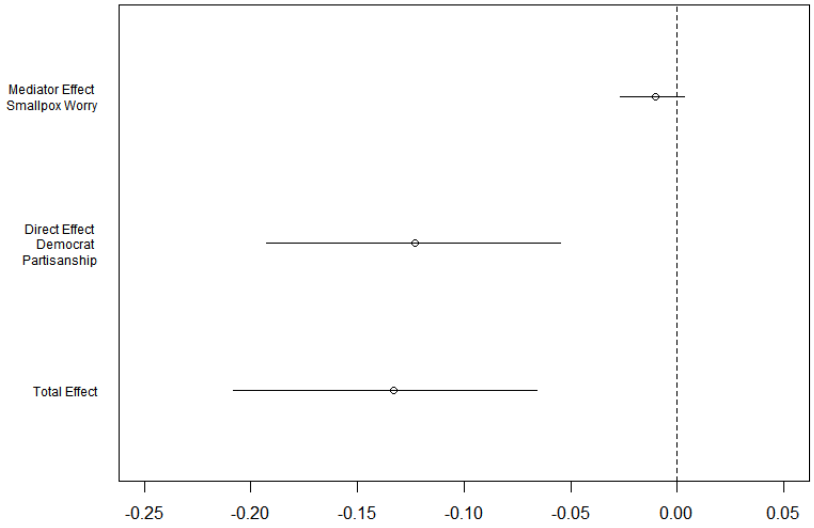


Smallpox

Due to data limitations[16], I was unable to test both the effects of disease worry and vaccine safety on the decision to vaccinate for smallpox. However, I was able to do a simple mediation model which examined the mediating effect of concern about a terrorist attack involving smallpox on the partisan difference in smallpox vaccination. If Republicans were more likely to vaccinate because they were more likely to be concerned about a terrorist attack involving smallpox, then the disease worry variable should significantly mediate the effect of partisanship on vaccination.

The results of the mediator model are presented in Figure A2. Worry about a terrorist attack involving smallpox was not a significant mediator of the effect of partisanship on decision to vaccinate. Democrats were significantly less likely to indicate that they would be willing to receive the smallpox vaccine, even after taking into account possible partisan differences in worry about smallpox exposure.

Figure 13: Does Disease Worry Mediate The Effect of Partisanship on Vaccination? (Smallpox)

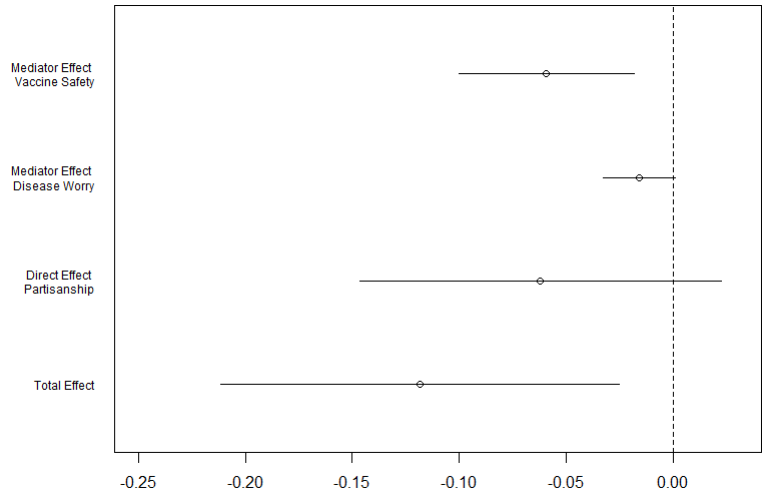


[16]The smallpox disease worry and vaccine safety questions were asked on separate surveys

H1N1

In the case of H1N1, I was able to run the complete multiple mediator model comparing the mediation effects of disease worry and vaccine safety on partisans' decision to vaccinate. Figure A3 shows that, as in the case of smallpox, worry about H1N1 did not significantly mediate the effect of partisanship on vaccination. On the other hand, concern about vaccine safety was a significant mediator for partisanship. This suggests that Democrats were more likely to vaccinate for H1N1 because they were more confident in the safety of the vaccine, not because they were more worried about H1N1.

Figure 14: Does Disease Worry or Vaccine Safety Mediate The Effect of Partisanship on Vaccination? (H1N1)



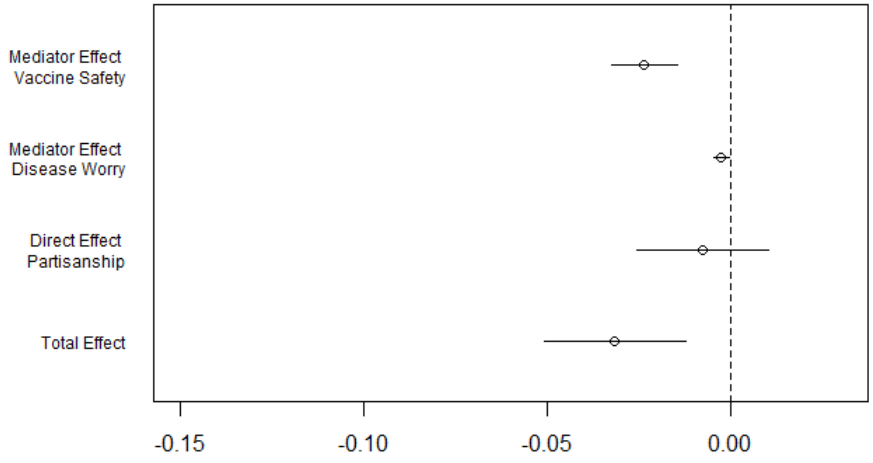
Measles

The case of measles was similar to the case of H1N1. Again, as shown by figure A4, concern about the disease had no significant mediating effect, while perceptions of vaccine safety/efficacy had a strong and significant mediating effect.

In all three cases, concern about the disease did not significantly mediate the effect of partisanship on vaccination decision. On the other hand, in both cases where vaccine safety was

tested as a mediator, if did significantly mediate the partisan effect. This suggests that partisans of the president's party are more likely to vaccinate because they are less concerned about the safety of the vaccine, rather than more concerned about the danger of the disease.

Figure 15: Does Disease Worry or Vaccine Safety Mediate The Effect of Partisanship on Vaccination? (Measles)



Full Regression Tables

Survey Data

Behavioral Data

Table 8: Smallpox Safety

	Dependent variable:	
	Safety (Serious Illness)	Safety (Death)
Republican	–	–
Independent	-0.371*(0.156)	-0.217(0.16)
Democrat	-0.433**(0.163)	-0.33†(0.174)
Age	0.004(0.004)	0(0.004)
Female	-0.342**(0.125)	-0.299*(0.123)
HS Grad	0.067(0.239)	0.5*(0.24)
Technical School	0.013(0.441)	0.333(0.459)
Some College	0.254(0.244)	0.545*(0.25)
College Grad	0.782**(0.254)	1.236**(0.259)
Post Grad	0.531†(0.285)	0.978**(0.294)
Income $10,000 but less than $15,000	-0.017(0.322)	-0.228(0.383)
Income $15,000 but less than $20,000	0.164(0.359)	0.197(0.345)
Income $20,000 but less than $25,000	0.509(0.365)	-0.118(0.379)
Income $25,000 but less than $30,000	1.219**(0.333)	0.702*(0.354)
Income $30,000 but less than $40,000	0.988**(0.315)	0.417(0.339)
Income $40,000 but less than $50,000	0.832**(0.317)	0.703*(0.326)
Income $50,000 but less than $75,000	0.693*(0.286)	0.511(0.329)
Income $75,000 but less than $100,000	0.702*(0.304)	0.484(0.339)
Income $100,000 or more	0.605*(0.303)	0.346(0.371)
Black	-0.603*(0.252)	-0.783**(0.246)
Hispanic	-0.006(0.276)	-0.461(0.284)
Other	-0.49(0.298)	-0.472(0.295)
Very likely|Somewhat likely	-1.56**(0.363)	-2.147**(0.389)
Somewhat likely|Not very likely	0.22(0.358)	-0.566(0.379)
Not very likely|Not likely at all	2.175**(0.364)	1.3**(0.379)
Observations	961	967
Akaike Inf. Crit.	2422.644	2302.19
Note:	†p<0.1; *p<0.05; **p<0.01	

Table 9: Smallpox Vaccination

	Dependent variable:
	Vaccination
Republican	–
Independent	-0.572*(0.253)
Democrat	-0.588**(0.146)
Age	0.006(0.004)
Female	-0.158(0.136)
Some HS	0.546(0.7)
HS grad	-0.036(0.65)
Technical/Trade school	-0.535(0.72)
Some college	-0.129(0.661)
College grad	-0.409(0.668)
Post grad	-0.241(0.666)
income 10-14K	0.57(0.524)
income 15-20K	0.477(0.484)
income 20-30K	0.333(0.445)
income 30-50K	0.661(0.432)
income 50-75K	1.017*(0.449)
income >75K	0.856†(0.443)
Asian	0.472(0.554)
Black	0.074(0.286)
Hispanic	0.778*(0.311)
Other	-0.251(0.359)
(Intercept)	-0.296(0.76)
Observations	965
Akaike Inf. Crit.	1323.104
Note:	†p<0.1; *p<0.05; **p<0.01

Table 10: H1N1 Safety + Vaccination

	Dependent variable:	
	Safety	Vaccination
Democrat	–	–
Independent	-0.221(0.265)	-0.452(0.289)
Republican	-0.621**(0.132)	-0.455**(0.152)
Age	0.014**(0.004)	0.01*(0.004)
Female	-0.592**(0.125)	0.017(0.143)
Some high school	0.058(0.849)	-1.653(1.146)
Graduated high school	-0.315(0.821)	-1.952†(1.122)
Some college	-0.376(0.822)	-2.212*(1.124)
Graduated College	0.124(0.829)	-1.435(1.126)
Post-graduate	0.376(0.832)	-1.044(1.129)
income 100 thousand or more	0.382(0.245)	-0.268(0.278)
income 20 to under 35 thousand	0.045(0.229)	-0.247(0.26)
income 35 to under 50 thousand	0.159(0.229)	-0.171(0.271)
income 50 to under 75 thousand	0.338(0.224)	0.027(0.263)
income 75 to under 100 thousand	0.352(0.246)	-0.265(0.285)
Asian	-0.58(0.602)	0.88(0.637)
Black	-0.845**(0.244)	-0.58†(0.298)
Hispanic	-0.313(0.265)	-0.078(0.334)
Other	-0.207(0.283)	0.029(0.301)
Constant		1.064(1.147)
Somewhat confident|Very confident	1.359(0.852)	
Not so confident|Somewhat confident	-0.763(0.852)	
Not confident at all|Not so confident	-2.226**(0.855)	
Akaike Inf. Crit.	2388.275	1242.126
Observations	978	962

Note: †p<0.1; *p<0.05; **p<0.01

Table 11: MMR Safety + Vaccination

	Dependent variable:	
	Safety	Vaccination
Democrat	–	–
Independent	−0.766** (0.077)	−1.012** (0.125)
Republican	−0.378** (0.072)	−0.410** (0.134)
Age	0.017** (0.002)	0.025** (0.003)
Female	0.267** (0.059)	0.487** (0.101)
Some HS	−0.156 (0.439)	0.254 (0.572)
HS grad	−0.066 (0.406)	0.259 (0.523)
Some college	0.019 (0.405)	0.547 (0.523)
College grad	0.195 (0.407)	0.671 (0.529)
Post Grad	0.492 (0.412)	1.064† (0.553)
Asian	−0.186 (0.148)	0.384 (0.295)
Black	−0.417** (0.089)	−0.503** (0.145)
Hispanic	−0.130 (0.099)	−0.054 (0.161)
Other	−0.164 (0.165)	−0.391 (0.239)
Constant		0.754 (0.540)
Not at all| Not very	-2.795** (0.419)	
Not very| Somewhat	-1.412** (0.413)	
Somewhat| Very	0.655 (0.413)	
Observations	4,570	4,570
Log Likelihood		−1,442.736
Akaike Inf. Crit.		2,913.472
Note:		†p<0.1; *p<0.05; **p<0.01

Table 12: CA PBE and Vaccination Rates

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	0.889^{**} (0.247)	-1.714^{**} (0.190)
Obama Admin	0.454^{**} (0.030)	-0.657^{**} (0.016)
% 2008 Dem vote x Obama	-0.347^{**} (0.047)	0.585^{**} (0.022)
Year	0.047^{**} (0.002)	0.014^{**} (0.001)
% Black	-2.760^{**} (0.766)	0.643 (0.590)
% Hisp	-4.524^{**} (0.202)	2.283^{**} (0.150)
% Asian	-4.316^{**} (0.357)	2.199^{**} (0.276)
Median HH Income	$-0.102^{\dagger}$ (0.057)	0.133^{**} (0.044)
% Bacc	1.164^{**} (0.427)	-0.392 (0.333)
% Urban	-0.244^{**} (0.093)	0.275^{**} (0.072)
Constant	-3.373^{**} (0.136)	2.536^{**} (0.105)
Observations	10,009	10,009
Log Likelihood	$-26{,}141.980$	$-54{,}313.440$
Akaike Inf. Crit.	52,307.960	108,650.900
Bayesian Inf. Crit.	52,394.490	108,737.400
Note:		†p<0.1; *p<0.05; **p<0.01

Table 13: Controlling for Lagged Disease

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	0.762 (0.762)	-1.553^{*} (0.665)
Obama Admin	0.336^{**} (0.041)	-0.812^{**} (0.024)
% 2008 Dem vote x Obama	-0.443^{**} (0.071)	0.893^{**} (0.047)
VPD Rate	-665.099^{**} (36.115)	-207.596^{**} (17.859)
VPD Rate x Obama	347.527^{**} (40.989)	150.001^{**} (30.091)
Year	0.064^{**} (0.002)	0.010^{**} (0.001)
% Black	$-4.262^{\dagger}$ (2.358)	-0.295 (2.061)
% Asian	-5.466^{**} (1.227)	2.332^{*} (1.079)
% Hisp	-3.898^{**} (0.586)	1.974^{**} (0.512)
% Bacc	2.409 (1.713)	-1.940 (1.497)
Median HH Income	-1.232 (0.867)	$1.262^{\dagger}$ (0.758)
% Urban	$0.631^{\dagger}$ (0.372)	0.151 (0.321)
Constant	-130.781^{**} (3.525)	-16.693^{**} (1.810)
Observations	796	796
Log Likelihood	$-4{,}483.410$	$-9{,}727.869$
Akaike Inf. Crit.	8,994.820	19,483.740
Bayesian Inf. Crit.	9,060.334	19,549.250

Note: †p<0.1; *p<0.05; **p<0.01

Table 14: Controlling for Lagged Vaccination

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	$0.429^{\dagger}$ (0.224)	-1.058^{**} (0.143)
Obama Admin	0.460^{**} (0.031)	-0.339^{**} (0.048)
% 2008 Dem vote x Obama	-0.230^{**} (0.048)	0.448^{**} (0.023)
Lag PBE Rate	3.171^{**} (0.124)	
Lag PBE x Obama	-1.756^{**} (0.101)	
Lag Vaccination Rate		3.003^{**} (0.047)
Lag Vaccination x Obama		-0.198^{**} (0.048)
Year	0.041^{**} (0.002)	0.016^{**} (0.001)
% Black	-2.232^{**} (0.685)	0.356 (0.433)
% Hisp	-4.135^{**} (0.184)	1.652^{**} (0.113)
% Asian	-4.016^{**} (0.317)	1.713^{**} (0.202)
Median HH Income	$-0.084^{\dagger}$ (0.051)	0.083^{*} (0.033)
% Bacc	1.188^{**} (0.385)	-0.296 (0.248)
% Urban	-0.179^{*} (0.083)	0.136^{**} (0.053)
Constant	-3.396^{**} (0.123)	-0.276^{**} (0.090)
Observations	9,936	9,936
Log Likelihood	$-25{,}927.730$	$-51{,}141.210$
Akaike Inf. Crit.	51,883.460	102,310.400
Bayesian Inf. Crit.	51,984.310	102,411.300
Note:		†p<0.1; *p<0.05; **p<0.01

Table 15: Controlling for Income Effects

	Dependent variable:	
	PBE Rate	Vaccination Rate
% 2008 Dem vote	0.894^{**} (0.247)	-1.665^{**} (0.190)
Obama Admin	0.460^{**} (0.030)	-0.609^{**} (0.016)
% 2008 Dem vote x Obama	-0.347^{**} (0.047)	0.509^{**} (0.023)
Median HH Income	-0.090 (0.057)	0.176^{**} (0.044)
Median HH Income x Obama	-0.020^{*} (0.008)	-0.080^{**} (0.004)
Year	0.047^{**} (0.002)	0.015^{**} (0.001)
% Black	-2.778^{**} (0.767)	0.639 (0.595)
% Hisp	-4.527^{**} (0.202)	2.282^{**} (0.150)
% Asian	-4.312^{**} (0.356)	2.192^{**} (0.277)
% Bacc	1.158^{**} (0.428)	-0.397 (0.334)
% Urban	-0.245^{**} (0.093)	0.275^{**} (0.072)
Constant	-3.377^{**} (0.136)	2.504^{**} (0.105)
Observations	10,009	10,009
Log Likelihood	$-26{,}138.930$	$-54{,}136.080$
Akaike Inf. Crit.	52,303.860	108,298.200
Bayesian Inf. Crit.	52,397.610	108,391.900
Note:		†p<0.1; *p<0.05; **p<0.01

Methodology Appendix

Case and Survey Information

Smallpox (2003)

In the aftermath of the 9/11 attacks, the US government was concerned about the potential of bioterrorism using smallpox or other infectious agents. On Dec 13, 2002, the Bush administration announced a voluntary smallpox vaccination program, which aimed to vaccinate target groups of healthcare workers to protect against a potential bioterror attack. However, smallpox vaccination does carry some serious but very rare side effects (about one in one million people vaccinated will experience these effects). I used survey data to estimate how partisanship affected perceptions of the smallpox vaccine.

Perceptions of vaccine safety were measured using several questions from the nationally representative April 2003 Harvard School of Public Health Smallpox survey (n = 1,003), which asked respondents about the probability of experiencing a range of side effects such as serious illness or death from the smallpox vaccine. This variable was reported on a four-point scale ranging from "not likely at all" to "very likely", and 26% of all respondents claimed that death was a very or somewhat likely side effect. To evaluate the effect of partisanship on responses to this question, I used a ordered logit model. I controlled for demographic variables, including gender, age, race, income, and education, as many of these variables have been previously found to affect partisanship and attitudes towards vaccines.

Willingness to vaccinate was measured with a question from the nationally representative January 2003 Gallup/CNN/USA Today poll (n= 1,000), which asked respondents whether they would get the smallpox vaccine if it were to become available. The responses were fairly equally split, with 53% of all respondents saying they would get the vaccine, and 44% say-

ing they would not. To evaluate the effect of partisanship on willingness to vaccinate, I used a binomial logit model.

Survey Questions: I used a smallpox vaccination intent question from the Gallup/CNN/USA Today poll in January 2003.

> *"Health authorities say there's a small risk from the smallpox vaccine. Out of every one million people who get the vaccine for the first time, one or two will die and up to 50 people will face serious complications. Considering the risk versus the benefit, would you, yourself, get a smallpox vaccine if it were available, or not?"*

The question was from a SARS survey conducted by the Harvard School of Public Health in April 2003.

> *"If you were to be (vaccinated/re-vaccinated) for smallpox, how likely do you think it is that you would experience the following sorts of side effects from the vaccination? Sore Arm? Serious Illness? Death?"*

H1N1 (2009)

H1N1 emerged as a global health concern in April 2009. In late October 2009, the US government began a campaign to vaccinate the population against H1N1. There were virtually no serious side effects reported as a result of vaccination (Broder et al. 2009). I used polling data to estimate partisan differences in perceptions of H1N1 vaccine safety and willingness to vaccinate for H1N1.

Perceptions of vaccine safety were measured using several questions from the nationally representative October 2009 ABC/Washington Post survey (n = 1,004), which asked respondents about their confidence in the safety of the H1N1 vaccine. This variable was reported on

a four-point scale from "Not at all confident" to "Very confident", with 30% of all respondents "Not confident" or "Not very confident" in the safety of the vaccine. To evaluate the effect of partisanship on beliefs about H1N1 vaccine safety, I used a ordered logit model and controlled for the same demographic variables as in the previous section. Again, my main independent variable of interest was partisanship, and as in the previous regression all leaners were coded as partisans.

Willingness to vaccinate was measured with a question from the same ABC/Washington Post survey, which asked respondents whether they were willing to get vaccinated for H1N1. In this case, 62% of respondents said that they were unlikely to get the H1N1 vaccine. To evaluate the effect of partisanship on willingness to vaccinate, I used a binomial logit model. In addition to controlling for demographic variables, I also controlled for respondent's worry about being personally affected by the H1N1 epidemic.

Survey Questions: To test the effect of partisanship on H1N1 vaccination, I relied on an ABC/Washington Post H1N1 survey administered in mid-October 2009.

The H1N1 vaccination intent question read:

> *"Thinking now about the swine flu vaccine – not the vaccine for regular flu, but the one specially developed this year for swine flu – do you plan to get the swine flu vaccine this year, or do you think you probably will not get the swine flu vaccine?"*

For the case of H1N1, I used a vaccine safety question from the same October ABC/Washington Post 2009 survey,which read:

> *"How confident are you that the swine flu vaccine is safe: very confident, somewhat confident, not so confident or not confident at all?"*

For the H1N1 survey, I used a question which measured trust in the federal government's ability to handle H1N1

> *How confident are you in the federal government's ability to respond effectively to an outbreak of swine flu in the United States - very confident, somewhat confident, not so confident or not confident at all?*

For the H1N1 media consumption survey, I used the October 9-11 2009 Pew News Interest Index Survey. The H1N1 news interest question read:

> *As I read a list of some stories covered by news organizations this past week, please tell me if you happened to follow each news story very closely, fairly cl osely, not too closely, or not at all closely: Reports about swine flu and the vaccine*

The Government Trust question read:

> *How confident are you in the government's ability to deal with the swine flu? Very confident, Somewhat confident, Not too confident, Not confident at all?*

The H1N1 vaccine choice question read:

> *If the swine flu vaccine was availa ble to you, would you get it or not?*

Measles (2015)

I examined a second case of government vaccine recommendations under a Democratic president - the case of measles. In 2000, measles was declared "eliminated" from the US. On average, fewer than 100 cases of measles per year were reported between 2001 and 2013. How-

ever, 2014 yielded over 600 cases of measles, including outbreaks linked to unvaccinated communities in Ohio and California (Control and Prevention 2015). In 2014, the Obama administration expressed support for universal measles vaccination. Once again, I used polling data to examine partisans' perceptions of vaccine safety and willingness to vaccinate.

To collect data on attitudes toward the measles vaccination, I ran a nationally diverse survey through Survey Sampling International (n = 4570) that asked questions about MMR vaccine safety and efficacy, concern over measles, and vaccine choice. This survey was fielded in April 2015. The MMR safety and efficacy questions from the survey were highly correlated (Cronbach's $\alpha = 0.87$), so I averaged them into one scale which I label vaccine evaluation, which I use as my dependent variable. Of all respondents, 13.7% scored less than a 3 on the vaccine evaluation scale, which meant that they believe that the MMR was either unsafe, ineffective, or both. As in previous regressions, my independent variable of interest is partisan identification, and I control for the same demographic variables. As vaccine evaluation was the average of two variables, rather than a categorical variable, I used an OLS regression to test the effect of partisanship on MMR vaccine evaluation.[17]

To examine the effect of partisanship on vaccination, I used a question from the same survey which asked respondents if they would vaccinate their child for MMR, or if they would seek an exemption. Only 10.6% of respondents claimed that they would seek an exemption, a number which closely matched the percentage of respondents who expressed doubts about the safety of the vaccine. I controlled for demographics and worry about measles, and my independent variable of interest was partisan identification. As in all previous vaccine choice regressions, I used a binomial logit model.

Survey Questions: For my data on the measles vaccination, I ran a nationally diverse survey experiment (n = 4570). This survey experiment had four conditions that contained cues that

[17]Running separate ordinal logit regressions using MMR safety or efficacy as the DV yielded substantively the same results

identified Democrats Obama and Hillary Clinton as universal MMR vaccine supporters, cues that identified Republicans Christie and Paul as proponents of parental vaccine choice, both cues, or neither cue.

I asked the following question about intent to vaccinate for measles:

> *If you were the parent of a school-age child, would you vaccinate your child with the MMR vaccine, or would you seek an exemption?*

On the measles survey, I asked the following question about measles vaccine safety:

> *How confident are you in the safety of the measles-mumps-rubella (MMR) vaccine?*

I used the following question to measure trust in government on the measles survey:

> *How much of the time do you think you can trust the current presidential administration to do what is right?*

Mediation

Multiple imputation is a statistical method that can generate an estimate of a missing value. I used multiple imputation to correct for missing covariate data in the surveys. Multiple imputation is useful is because specific subsets of data may be excluded due to non-response (for example, less educated respondents may be less likely to respond to a party identification question). Simply deleting this data (listwise deletion) is inefficient at best, and may produce biased estimates. This missing data can be predicted using multiple imputation, given that certain assumptions hold (King et al. 2001). I used the Amelia package to generate my multiply

imputed data, with n=5 imputations. For every regression model, I ran a separate set of multiple imputations. I discarded all observations that were missing in the dependent variable, and ran multiple imputation using all variables included in the model[18].

I used the causal mediation analysis provided by mediation R package Tingley et al. 2013, to estimate the the average direct effect of partisanship and the effect of the mediator. First, I used multiple imputation to correct for missing data. Then, I ran my mediator model on each of the 5 imputed datasets separately and I used the combining rule described in Rubin (2004) to get the estimate and standard errors for the average causal mediation effect on the main mediator. In all mediation models, I also included the covariates that I used in my regressions - race, age, gender, education, and income. In all of my mediation analyses, I only look at the difference between Democrats and Republicans, not pure Independents[19].

Topics for NVIC vs Mainstream Media Validation Check

The three topics used in the validation are bolded and marked with an "X".

[18]The results were substantively similar whether or not I used multiple imputation

[19]pure Independents make up only about 10% of my sample. The mediation results are similar when they are included.

Table 16: LDA Topics

Validation	Total pct	Topic Words
X	0.054	**vaccine, vaccines, children, parents, health, people, doctors, risks, public, vaccination, safety, risk, child, medical, make, science, effects, time, safe, government**
	0.043	vaccine, children, percent, measles, disease, vaccines, age, doses, people, years, months, received, dose, risk, recommended, cdc, adults, vaccinated, year, mumps
	0.041	vaccine, flu, health, million, doses, vaccines, states, officials, united, government, company, year, supply, drug, make, federal, swine, production, smallpox, shortage
	0.031	vaccine, flu, influenza, vaccines, virus, swine, people, strain, year, strains, seasonal, effective, season, pandemic, nasal, shot, viruses, protect, percent, time
	0.030	vaccine, vaccines, ebola, trials, virus, clinical, aids, trial, zika, research, health, experimental, effective, people, development, developed, scientists, disease, develop, years
	0.028	vaccines, diseases, vaccine, countries, turn, baby, pediatricians, global, checkups, battlegrounds, world, gates, foundation, poor, developing, alliance, drugs, market, billion, return
	0.027	vaccine, injury, law, reactions, memorial, nvic, death, today, preventing, families, educate, donating, victims, international, newsletter, info, video, e-news, search, faqs
	0.025	vaccine, vaccines, virus, immune, system, cells, cancer, human, dna, response, antibodies, live, disease, viruses, made, researchers, make, cell, blood, infection
	0.024	vaccine, safety, research, public, national, vaccines, health, institute, medicine, director, disease, study, university, medical, center, control, published, group, independent, government
	0.024	vaccine, health, vaccines, children, state, school, medical, care, parents, exemption, child, public, workers, required, vaccination, exemptions, recommended, doctors, department, schools
X	0.023	**vaccine, committee, advisory, statements, adverse, vaccines, events, reporting, vaers, effects, report, reaction, system, event, reports, medicine, safety, reactions, institute, related**
	0.022	vaccine, vaccines, drug, companies, anthrax, government, liability, pharmaceutical, manufacturers, federal, court, health, fda, administration, food, industry, officials, congress, lawsuits, military
X	0.022	**vaccine, vaccines, autism, brain, children, chronic, dpt, system, immune, reactions, vaccination, effects, reaction, studies, medical, evidence, dysfunction, inflammation, death, side**
	0.020	vaccine, ingredient, calculator, hpv, cancer, cervical, gardasil, girls, human, women, papillomavirus, merck, sexually, virus, prevent, young, boys, approved, strains, types
	0.020	vaccine, national, information, center, injury, compensation, copyright, program, act, childhood, federal, injuries, injured, nvic, children, parents, claims, vicp, congress, deaths
	0.018	vaccine, state, informed, consent, exemptions, nvic, bills, vaccination, rights, advocacy, tracking, freedom, public, medical, laws, states, information, health, make, choice
	0.018	vaccine, pertussis, vaccines, tetanus, pregnant, diphtheria, women, cough, whooping, acellular, hepatitis, influenza, children, fda, dtap, tdap, dose, licensed, product, cell
	0.013	vaccine, polio, virus, smallpox, oral, live, vaccines, children, health, salk, disease, people, measles, made, strain, workers, vaccinia, contaminated, world, vaccination
	0.011	vaccine, information, nvic, vaccines, barbara, product, vaccination, fisher, loe, informed, health, making, manufacturer, inserts, decision, reaction, child, resources, care, links
	0.010	vaccine, article, page, headline, edition, version, appears, print, york, national, vaccines, flu, anti-vaccine, news, october, paper, editorial, autism, documentary, science